

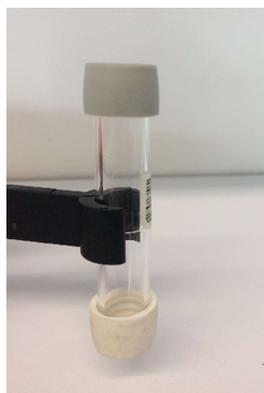
Nitrogen Dioxide (NO₂) Monitoring Toolkit

Nitrogen dioxide (NO₂) is a gas produced by the reaction of nitrogen and oxygen during combustion processes. These oxides of nitrogen, known as NOX (pronounced knocks), take part in chemical reactions in the air changing, into nitric acid and nitrates, which may remain in the air as very small particles.

As an irritant gas, NO₂ can damage cell membranes and proteins. High concentrations can produce airway inflammation (experienced as cough, chest tightness and difficulty breathing), and may lead to narrowing of lung airways, particularly among people with pre-existing asthma. After exposure to NO₂ concentrations of 200-400 ppb (Parts per billion – a unit of measurement for example one microgram in a litter of water is 1 ppb) for one hour, asthma sufferers' airways may become more sensitive to other irritants found in the air we breathe. This outdoor air concentration is found occasionally in the United Kingdom.

Studies on the effects of long term exposure to nitrogen dioxide have been associated to increases in non-accidental mortality, cardiovascular diseases and lung cancer (Cesaroni *et al.*, 2013).¹ Studies in Switzerland and the United States suggest people living in areas with higher NO₂ exposures have poorer lung function. Other similar studies have not found this link.

Diffusion Tubes are made from clear plastic, with a rubber stopper at each end. Designed for passive monitoring of gaseous airborne NO₂.



¹ Long-Term Exposure to Urban Air Pollution and Mortality in a Cohort of More than a Million Adults in Rome

They are commonly used by Local Authorities to obtain data in addition to those from high-end fixed monitoring stations.

The tubes work by collecting information about NO₂ using a steel mesh coated with a chemical called triethanolamine (TEA), which is located at the end of the tube with the grey stopper, see image. TEA absorbs nitrogen from the air when the white stopper is removed, and the laboratory analysis can show the levels of the pollutant in the air (N.B. the grey cap should never be removed and tubes should always be positioned to allow the air to circulate freely).



The results provide an average over the period when the tube was exposed to the environment. For more details, see [AEA Report](#).

Diffusion tubes can be positioned across various sites; on lampposts, street signs, a fence or other appropriate sites. They should be left in the location for a month, and then sent to the laboratory for analysis. The results from the analysis can be added to the 'Air Quality Community Map' to be shared with others.

Materials Needed:

To perform the sampling process, you will need:

- Diffusion tubes
- Tube holders and cable tie
- Survey sheets
- Maps
- Clipboard
- Re-sealable samples bag
- Pen

Collecting NO₂ samples - Instructions



***** Please read through the instructions carefully before carrying out the survey. *****

Locate ⇒ Fix ⇒ Sample ⇒ Record ⇒ Collect ⇒ Repeat

LOCATE: Select a suitable site to position the diffusion tube. Where possible, try and place the tube at breathing height. In most public places this may not be feasible. To reduce loss or theft, it is recommended that tubes are placed at a height of 1.5m - 2m on public thoroughfares. **Remember**, the further away from the road, the less likely your readings may be to reflect the levels you are exposed to whilst walking around your community. Note, Defra guidance on height recommends 2-4m (this recommendation is based on standardizing for comparison across sites see: http://laqm.defra.gov.uk/documents/0802141004_NO2_WG_PracticalGuidance_Issue1a.pdf).

FIX: Position tube **vertically** and insert into holder with **WHITE** cap facing downwards. Remove backing to sticky tape on the holder. Attach with cable ties (or string) if fixing to a pipe or lamppost. Make sure there is free circulation of air around the tube and that it is positioned more than 10m away from air-conditioning outlets, extractor vents or heater flues.



SAMPLE: On the coordinated start day, once in position, remove the **WHITE** cap which should be facing **downwards**. **DO NOT REMOVE THE GREY CAP** (you should see the absorber- small mesh inside the tube, beneath the grey cap). Leave tube in position for the 4-week exposure period, or until the specified changeover day. Remember to keep the white cap in a safe place as you will need to replace this to return the tube for analysis.



RECORD: Fill in the site sheet with as much detail as possible about the location of the tube. **Mark 'x' on the map** provided to identify the **sampling location** and include the site number on the map. Record any information that will help identify the location if someone else needs to collect the tube and also to help explain the results when you get them. Complete the monthly record sheet ensuring accurate **date and times** are recorded. Store the cap, map and record sheets in the re-sealable sample bag.

COLLECT: After the 4-week exposure period, collect the tube from its location and instantly **replace the WHITE** cap securely on the end of the tube (**leave the grey cap in place**). Note any details regarding the tube condition, changes in site conditions, or anything that might affect the results. Record collection date and time on the survey record sheet and place everything in the re-sealable bag with your name clearly marked on it. Ensure the bag is tightly sealed.

You have now completed all the steps necessary to collect your data! All you need to now is to send your sample/s off to the lab for analysis and wait for the results. The lab may have their own record sheet that you will be required to complete when sending samples in for analysis. Once you have your results be sure to enter them onto the [Air Quality Monitoring Community Map](#).

Please note: the diffusion tubes should be stored in a cool place before and after use and have a limited shelf-life.



Diffusion tubes – Site Sheet

Surveyor Name:

Contact Details:

Site Number:

| Details of your tube position | (please fill in as much detail as you can and mark the position on the map provided) |
|--|---|
| Map Grid Ref. (e.g. 1) | |
| Name of Road | |
| Location Description (e.g. residential street, park, high street). | |
| Approximate height tube positioned off the ground in metres | |
| Approximate height of tube from street level in metres | |
| Site Characteristics (e.g. building/road works, traffic diversion) | |
| Any other information | |



Diffusion tubes – Record Sheet

Surveyor Name:

Site Number:

| DETAILS | PLEASE COMPLETE ALL THE BOXES |
|---|-------------------------------|
| Tube barcode number | |
| Start date | |
| Start time (24 hour clock) | |
| Finish date | |
| Finish time (24 hour clock) | |
| Tube condition (e.g. tube found on the ground, dirt, insect or liquid inside tube) | |
| Any changes in positioning of tube since last month | |

Purchasing equipment

Diffusion tubes can be purchased from Gradko International Ltd and other suppliers. The tube price (~£8.00) plus p&p which includes the cost of lab analysis. If you are a charity or grassroots community group, you may be able to negotiate a lower price. Gradko also sell tube holders and ties to fasten to lampposts and other objects. If you are a keen DIY person you can make your own from some rigid corrugated plastic.

Make it count

Why not hold a community meeting to share your results and begin thinking about what steps can be taken to reduce your exposure to poor air quality and deliver change real change.

More help?

If you would like Mapping for Change to support you with your air quality project, please [contact us](#) for a quote.